Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A method for determining at least one of a stiffness matrix and a residual vector for one or more systems, the method ~~executed in a computer system for producing a combined system of partial differential equations~~ comprising:

receiving a selection of one or more systems;

~~representing each of a plurality of systems as an application mode modeling physical quantities of said each system;~~

~~determining a representation of a partial differential equation system for each of the application mode corresponding to one of said plurality of systems using at least one non-local coupling, said the at least one non-local coupling determining a value in at least one portion of a domain depending on a value from at least one other portion of the domain; and~~

~~producing a model by forming said a combined system of partial differential equations using the determined partial differential equation systems associated with said plurality of systems;~~

determining for the selected one or more systems at least one of the stiffness matrix by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of the variable, the stiffness matrix being a Jacobian matrix of a residual vector with respect to a number of degrees of freedom, the Jacobian of a variable being represented as at least one contribution determined in accordance with a number of degrees of freedom and determining the residual vector by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of the variable; and

providing the determined at least one of the stiffness matrix and the residual vector for the selected one or more systems.

2. (Original) The method of Claim 1 wherein said non-local variable defines a value from a first domain in a first geometry to another domain in a second geometry.

3. (Original) The method of Claim 2, further comprising: forming, for each of said first and second geometries, a system of partial differential equations each having associated coupling variables.

4. (Original) The method of Claim 2, wherein at least one of said partial differential equation systems uses at least one local coupling.

5. (Original) The method of Claim 2, wherein said first and second geometries are the same.

6. (Original) The method of Claim 2, wherein said first and second geometries are different.

7. (Original) The method of Claim 1, further comprising:

defining a non-local coupling wherein a value of a quantity on a boundary of a first domain is referenced on parallel lines extending into said first domain.

8. (Original) The method of Claim 2, further comprising:

defining a non-local coupling in which a boundary condition associated with said first domain is defined using a value of an integral over a portion of one of: said first domain and said second domain.

9. (Original) The method of Claim 1, further comprising:

defining a non-local coupling using at least one of: a mapped variable and an integrated variable.

10. (Original) The method of Claim 4, further comprising:

defining a local coupling using at least one of: a basic variable, an auxiliary variable, and a glued variable.

11. (Original) The method of Claim 1, further comprising:

defining a non-local coupling variable using at least one of: an extrusion variable, a projection variable, and a scalar coupling variable.

12. (Currently Amended) The method of Claim 1~~, further comprising~~ wherein the determining determines [[a]] the stiffness matrix ~~by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of said variable wherein said combined system of partial differential equations is in weak form, said stiffness matrix being a Jacobian matrix of a residual vector with respect to a number of degrees of freedom, said Jacobian of a variable being represented as at least one contribution determined in accordance with a number of degrees of freedom;~~ and determining ~~said~~ the residual vector. ~~by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of said variable wherein said combined system of partial differential equations is in weak form~~ and wherein the providing provides the determined stiffness matrix and the determined residual vector for the selected one or more systems.

13. (Original) The method of Claim 12, further comprising: converting said combined system of partial differential equations from general form to weak form.

14. (Original) The method of Claim 12, wherein said determining said stiffness matrix further comprises:

determining at least one of a Jacobian of a variable and a value of a variable in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

15. (Original) The method of Claim 14, wherein said determining said residual vector further comprises:

determining at least one of a Jacobian of a variable and a value of a variable in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

16. (Original) The method of Claim 1, further comprising: determining a value of a variable in accordance with a type of said variable used in at least one of said partial differential equation systems.

17. (Original) The method of Claim 16, wherein variables are recursively evaluated in accordance with variable type.

18. (Original) The method of Claim 17, wherein said determining a value of a variable in accordance with a type is used in determining at least one of a: stiffness matrix, constraint matrix, residual vector and a constraint residual vector.

19. (Original) The method of Claim 18, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated variable.

20. (Original) The method of Claim 1, further comprising:

determining a Jacobian of a variable in accordance with a type of said variable used in at least one of said partial differential equations wherein said Jacobian of a variable is represented in accordance with a number of degrees of freedom.

21. (Original) The method of Claim 20, wherein a Jacobian of a variable is recursively evaluated in accordance with variable type.

22. (Original) The method of Claim 21, wherein said determining a Jacobian of a variable in accordance with a type is used in determining at least one of: a stiffness matrix, a residual vector, constraint residual vector, and a constraint matrix.

23. (Original) The method of Claim 22, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated variable.

24. (Original) The method of Claim 1, wherein said at least one non-local coupling includes a variable having a dependency on another variable at at least one distant point.

25. (Original) The method of Claim 24, wherein said other variable is in the same geometry as said variable.

26. (Original) The method of Claim 24, wherein said other variable is in a different geometry from said variable.

27. (Original) The method of Claim 4, wherein said local coupling includes a variable having a dependency only on values of other variables at the same point.

28. (Original) The method of Claim 1, further comprising:

defining a non-local coupling used in at least one of a: subdomain, boundary, edge, and point that obtains a value at one of: a subdomain, boundary, edge, and point.

29. (Original) The method of Claim 4, further comprising:

defining a local coupling using at least one of: an expression variable and a boundary coupled variable.

30. (Original) The method of Claim 1, further comprising:

defining a non-local coupling wherein a value of an integral of a variable along parallel lines extending into a first domain is used on a boundary on said first domain.

31. (Original) The method of Claim 1, further comprising:

defining a boundary condition on one boundary in terms of a value of a variable on another boundary wherein said value is mapped in accordance with a coordinate transformation.

32. (Original) The method of Claim 1, further comprising:

defining a boundary condition in terms of a variable defined at a single point.

33. (Currently Amended) A method for determining at least one of a stiffness matrix and a residual vector for one or more systems, the method ~~executed in a computer system for assembling a finite element discretization of a system of weak partial differential equations~~ comprising:

receiving a selection of one or more systems;

determining for the selected one or more systems a stiffness matrix by evaluating at least one of a Jacobian of a variable and a value of a variable in accordance with a type of ~~said~~ the variable included in ~~said system~~ the one or more selected systems, ~~said~~ the Jacobian of ~~said~~ the variable being represented as at least one contribution in accordance with a number of degrees of freedom;

determining a residual vector for the selected one or more systems by evaluating at least one of a Jacobian of a variable and a value of a variable in accordance with a type of ~~said~~ the variable included in ~~said system~~ the one or more selected systems, said Jacobian of said variable being represented as at least one contribution determined in accordance with a number of degrees of freedom; and

providing ~~a finite element discretization of said system based on said determining a~~ for the one or more selected systems the determined stiffness matrix and ~~said determining a~~ the determined residual vector.

34. (Original) The method of Claim 33, wherein said system includes at least one non-local coupling and said method further includes evaluating at least one variable in said non-local coupling in at least one of: said determining said stiffness matrix and said determining said residual vector.

35. (Original) The method of Claim 33, wherein said system includes at least one local coupling and said method further includes evaluating at least one variable in said local coupling in at least one of: said determining said stiffness matrix and said determining said residual vector.

36. (Original) The method of Claim 33, further comprising:

determining a constraint matrix by evaluating at least one of said Jacobian of a variable and a value of a variable in accordance with a type of said variable included in said system wherein said Jacobian of said variable is represented as at least one contribution in accordance with a number of degrees of freedom.

37. (Original) The method of Claim 36, further comprising:

determining a constraint residual vector by determining a value of at least one variable included in said system in accordance with a type of said at least one variable.

38. (Original) The method of Claim 37, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, an integrated variable.

39. (Original) The method of Claim 33, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, an integrated variable.

40. (Currently Amended) A computer readable medium having instructions stored thereon which when executed by at least one processor cause the processor to perform steps comprising:

receiving a selection of one or more systems;

~~representing each of a plurality of systems as an application mode modeling physical quantities of said each system;~~

~~determining a representation of a partial differential equation system for each of the application mode corresponding to one of said plurality of systems using at least one non-local coupling, said the at least one non-local coupling determining a value in at least one portion of a domain depending on a value from at least one other portion of the domain; and~~

~~producing a model by forming said a combined system of partial differential equations using the determined partial differential equation systems associated with said plurality of systems;~~

determining for the selected one or more systems at least one of the stiffness matrix by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of the variable, the stiffness matrix being a Jacobian matrix of a residual vector with respect to a number of degrees of freedom, the Jacobian of a variable being represented as at least one contribution determined in accordance with a number of degrees of freedom and determining the residual vector by determining at least one

of a Jacobian of a variable and a value of a variable in accordance with a type of the variable; and

providing the determined at least one of the stiffness matrix and the residual vector for the selected one or more systems.

41. (Previously Presented) The computer readable medium of Claim 40, wherein said non-local variable defines a value from a first domain in a first geometry to another domain in a second geometry.

42. (Previously Presented) The computer readable medium of Claim 41, further comprising:

forming, for each of said first and second geometries, a system of partial differential equations each having associated coupling variables.

43. (Previously Presented) The computer readable medium of Claim 41, wherein at least one of said partial differential equation systems uses at least one local coupling.

44. (Previously Presented) The computer readable medium of Claim 41, wherein said first and second geometries are the same.

45. (Previously Presented) The computer readable medium of Claim 41, wherein said first and second geometries are different.

46. (Previously Presented) The computer readable medium of Claim 40, further comprising:

defining a non-local coupling wherein a value of a quantity on a boundary of a first domain is referenced on parallel lines extending into said first domain.

47. (Previously Presented) The computer readable medium of Claim 41, further comprising:

defining a non-local coupling in which a boundary condition associated with said first domain is defined using a value of an integral over a portion of one of: said first domain and said second domain.

48. (Previously Presented) The computer readable medium of Claim 40, further comprising:

defining a non-local coupling using at least one of: a mapped variable and an integrated variable.

49. (Previously Presented) The computer readable medium of Claim 43, further comprising:

defining a local coupling using at least one of: a basic variable, an auxiliary variable, and a glued variable.

50. (Previously Presented) The computer readable medium of Claim 40, further comprising:

defining a non-local coupling variable using at least one of: an extrusion variable, a projection variable, and a scalar coupling variable.

51. (Currently Amended) The computer readable medium of Claim 40, ~~further comprising:~~ wherein the determining determines [[a]] the stiffness matrix ~~by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of said variable wherein said combined system of partial differential equations is in weak form, said stiffness matrix being a Jacobian matrix of a residual vector with respect to a number of degrees of freedom, said Jacobian of a variable being represented as at least one contribution determined in accordance with a number of degrees of freedom;~~ and determining ~~said~~ the residual vector. ~~by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of said variable wherein said combined system of partial differential equations is in weak form~~ and wherein the providing provides the determined stiffness matrix and the determined residual vector for the selected one or more systems.

52. (Previously Presented) The computer readable medium of Claim 51, further comprising:

converting said combined system of partial differential equations from general form to weak form.

53. (Previously Presented) The computer readable medium of Claim 51, wherein said determining said stiffness matrix further comprises:

determining at least one of a Jacobian of a variable and a value of a variable in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

54. (Previously Presented) The computer readable medium of Claim 53, wherein said determining said residual vector further comprises:

determining at least one of a Jacobian of a variable and a value of a variable in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

55. (Previously Presented) The computer readable medium of Claim 40, further comprising:

determining a value of a variable in accordance with a type of said variable used in at least one of said partial differential equation systems.

56. (Previously Presented) The computer readable medium of Claim 55, wherein variables are recursively evaluated in accordance with variable type.

57. (Previously Presented) The computer readable medium of Claim 56, wherein said determining a value of a variable in accordance with a type is used for determining at least one of a: stiffness matrix, constraint matrix, residual vector and a constraint residual vector.

58. (Previously Presented) The computer readable medium of Claim 57, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated variable.

59. (Previously Presented) The computer readable medium of Claim 40, further comprising:

determining a Jacobian of a variable in accordance with a type of said variable used in at least one of said partial differential equations wherein said Jacobian of a variable is represented in accordance with a number of degrees of freedom.

60. (Previously Presented) The computer readable medium of Claim 59, wherein a Jacobian of a variable is recursively evaluated in accordance with variable type.

61. (Previously Presented) The computer readable medium of Claim 60, wherein said determining a Jacobian of a variable in accordance with a type is used in determining at least one of: a stiffness matrix, a residual vector, constraint residual vector, and a constraint matrix.

62. (Previously Presented) The computer readable medium of Claim 61, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated variable.

63. (Previously Presented) The computer readable medium of Claim 40, wherein said at least one non-local coupling includes a variable having a dependency on another variable at at least one distant point.

64. (Previously Presented) The computer readable medium of Claim 63, wherein said other variable is in the same geometry as said variable.

65. (Previously Presented) The computer readable medium of Claim 63, wherein said other variable is in a different geometry from said variable.

66. (Previously Presented) The computer readable medium of Claim 43, wherein said local coupling includes a variable having a dependency only on values of other variables at the same point.

67. (Previously Presented) The computer readable medium of Claim 40, further comprising:

defining a non-local coupling used in at least one of a: subdomain, boundary, edge, and point that obtains a value at one of: a subdomain, boundary, edge, and point.

68. (Previously Presented) The computer readable medium of Claim 43, further comprising:

defining a local coupling using at least one of: an expression variable and a boundary coupled variable.

69. (Previously Presented) The computer readable medium of Claim 40, further comprising:

defining a non-local coupling wherein a value of an integral of a variable along parallel lines extending into a first domain is used on a boundary on said first domain.

70. (Previously Presented) The computer readable medium of Claim 40, further comprising:

defining a boundary condition on one boundary in terms of a value of a variable on another boundary wherein said value is mapped in accordance with a coordinate transformation.

71. (Previously Presented) The computer readable medium of Claim 40, further comprising:

defining a boundary condition in terms of a variable defined at a single point.

72. (Currently Amended) A computer readable medium having instructions stored thereon for ~~assembling a finite element discretization of a system of weak partial differential equations~~ determining at least one of a stiffness matrix and a residual vector for one or more systems which when executed by at least one processor cause the processor to perform steps comprising:

receiving a selection of one or more systems;

determining for the selected one or more systems a stiffness matrix by evaluating at least one of a Jacobian of a variable and a value of a variable in accordance with a type of ~~said~~ the variable included in ~~said system~~ the one or more selected systems, ~~said~~ the Jacobian of ~~said~~ the variable being represented as at least one contribution in accordance with a number of degrees of freedom;

determining a residual vector for the selected one or more systems by evaluating at least one of a Jacobian of a variable and a value of a variable in accordance with a type of ~~said~~ the variable included in ~~said system~~ the one or more selected systems, said

Jacobian of said variable being represented as at least one contribution determined in accordance with a number of degrees of freedom; and

providing ~~a finite element discretization of said system based on~~ ~~said determining a~~ for the one or more selected systems the determined stiffness matrix and ~~said determining a~~ the determined residual vector.

73. (Previously Presented) The computer readable medium of Claim 72, wherein said system includes at least one non-local coupling and further comprising evaluating at least one variable in said non-local coupling in at least one of: said determining said stiffness matrix and said determining said residual vector.

74. (Previously Presented) The computer readable medium of Claim 72, wherein said system includes at least one local coupling and comprises evaluating at least one variable in said local coupling in at least one of: said determining said stiffness matrix and said determining said residual vector.

75. (Previously Presented) The computer readable medium of Claim 72, further comprising:

determining a constraint matrix by evaluating at least one of said Jacobian of a variable and a value of a variable in accordance with a type of said variable included in said system wherein said Jacobian of said variable is represented as at least one contribution in accordance with a number of degrees of freedom.

76. (Previously Presented) The computer readable medium of Claim 75, further comprising:

determining a constraint residual vector by determining a value of at least one variable included in said system in accordance with a type of said at least one variable.

77. (Previously Presented) The computer readable medium of Claim 76, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, an integrated variable.

78. (Previously Presented) The computer readable medium of Claim 72, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, an integrated variable.

79. (New) A system for determining at least one of a stiffness matrix and a residual vector for one or more systems comprising:

a selection system that receives a selection of one or more systems;

a determination system that determines for the selected one or more systems at least one of the stiffness matrix by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of the variable, the stiffness matrix being a Jacobian matrix of a residual vector with respect to a number of degrees of freedom, the Jacobian of a variable being represented as at least one contribution determined in accordance with a number of degrees of freedom and determining the residual vector by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of the variable; and

an output system that provides the determined at least one of the stiffness matrix and the residual vector for the selected one or more systems.

80. (New) The system of Claim 79 wherein the non-local variable defines a value from a first domain in a first geometry to another domain in a second geometry.

81. (New) The system of Claim 80, further comprising a formation system that forms, for each of the first and second geometries, a system of partial differential equations each having associated coupling variables.

82. (New) The system of Claim 80, wherein at least one of the partial differential equation systems uses at least one local coupling.

83. (New) The system of Claim 80, wherein the first and second geometries are the same.

84. (New) The system of Claim 80, wherein the first and second geometries are different.

85. (New) The system of Claim 79, further comprising a definition system that defines a non-local coupling wherein a value of a quantity on a boundary of a first domain is referenced on parallel lines extending into the first domain.

86. (New) The system of Claim 80, further comprising a definition system that defines a non-local coupling in which a boundary condition associated with the first domain is defined using a value of an integral over a portion of one of the first domain and the second domain.

87. (New) The system of Claim 79, further comprising a definition system that defines a non-local coupling using at least one of: a mapped variable and an integrated variable.

88. (New) The system of Claim 82, further comprising a definition system that defines a local coupling using at least one of: a basic variable, an auxiliary variable, and a glued variable.

89. (New) The system of Claim 79, further comprising a definition system that defines a non-local coupling variable using at least one of: an extrusion variable, a projection variable, and a scalar coupling variable.

90. (New) The system of Claim 79 wherein the determination system determines the stiffness matrix and determines the residual vector and the output system provides the determined stiffness matrix and the determined residual vector.

91. (New) The system of Claim 90, further comprising a conversion system that converts the combined system of partial differential equations from general form to weak form.

92. (New) The system of Claim 90, wherein the matrix determination system determines at least one of a Jacobian of a variable and a value of a variable in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

93. (New) The system of Claim 92, wherein the vector determination system determines at least one of a Jacobian of a variable and a value of a variable in

accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

94. (New) The system of Claim 79, further comprising a value determination system that determines a value of a variable in accordance with a type of the variable used in at least one of the partial differential equation systems.

95. (New) The system of Claim 94, wherein variables are recursively evaluated in accordance with variable type.

96. (New) The system of Claim 95, wherein the value determination system determines a value of a variable in accordance with a type is used in determining at least one of a stiffness matrix, constraint matrix, residual vector and a constraint residual vector.

97. (New) The system of Claim 96, wherein the type is one of a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated variable.

98. (New) The system of Claim 79, further comprising a Jacobian determination system that determines a Jacobian of a variable in accordance with a type of the variable used in at least one of the partial differential equations wherein the Jacobian of a variable is represented in accordance with a number of degrees of freedom.

99. (New) The system of Claim 98, wherein a Jacobian of a variable is recursively evaluated in accordance with variable type.

100. (New) The system of Claim 99, wherein the Jacobian determination system determines a Jacobian of a variable in accordance with a type is used in determining at least one of a stiffness matrix, a residual vector, constraint residual vector, and a constraint matrix.

101. (New) The system of Claim 100, wherein the type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated variable.

102. (New) The system of Claim 79, wherein the at least one non-local coupling includes a variable having a dependency on another variable at at least one distant point.

103. (New) The system of Claim 102, wherein the other variable is in the same geometry as the variable.

104. (New) The system of Claim 102, wherein the other variable is in a different geometry from the variable.

105. (New) The system of Claim 82, wherein the local coupling includes a variable having a dependency only on values of other variables at the same point.

106. (New) The system of Claim 79, further comprising a definition system that defines a non-local coupling used in at least one of a subdomain, boundary, edge, and point that obtains a value at one of: a subdomain, boundary, edge, and point.

107. (New) The system of Claim 82, further comprising a definition system that defines a local coupling using at least one of: an expression variable and a boundary coupled variable.

108. (New) The system of Claim 79, further comprising a definition system that defines a non-local coupling wherein a value of an integral of a variable along parallel lines extending into a first domain is used on a boundary on the first domain.

109. (New) The system of Claim 79, further comprising a definition system that defines a boundary condition on one boundary in terms of a value of a variable on another boundary wherein the value is mapped in accordance with a coordinate transformation.

110. (New) The system of Claim 79, further comprising a definition system that defines a boundary condition in terms of a variable defined at a single point.

111. (New) A system for determining at least one of a stiffness matrix and a residual vector for one or more systems comprising:

a selection system that receives a selection of one or more systems;

a stiffness matrix determination system that determines for the selected one or more systems a stiffness matrix by evaluating at least one of a Jacobian of a variable and a value of a variable in accordance with a type of the variable included in the one or more selected systems, the Jacobian of the variable being represented as at least one contribution in accordance with a number of degrees of freedom;

a residual vector determination system that determines a residual vector for the selected one or more systems by evaluating at least one of a Jacobian of a variable and a value of a variable in accordance with a type of the variable included in the one or more selected systems, said Jacobian of said variable being represented as at least one contribution determined in accordance with a number of degrees of freedom; and

an output system that provides the determined stiffness matrix and the determined residual vector.

112. (New) The system of Claim 111, wherein the system includes at least one non-local coupling and the system further includes evaluating at least one variable in the non-local coupling in at least one of: the determining the stiffness matrix and the determining the residual vector.

113. (New) The system of Claim 111, wherein the system includes at least one local coupling and the system further includes an evaluation system that evaluates at least one variable in the local coupling in at least one of: the determining the stiffness matrix and the determining the residual vector.

114. (New) The system of Claim 111, further comprising a matrix determination system that determines a constraint matrix by evaluating at least one of the Jacobian of a variable and a value of a variable in accordance with a type of the variable included in the system wherein the Jacobian of the variable is represented as at least one contribution in accordance with a number of degrees of freedom.

115. (New) The system of Claim 114, further comprising a vector determination system that determines a constraint residual vector by determining a value of at least one variable included in the system in accordance with a type of the at least one variable.

116. (New) The system of Claim 115, wherein the type is one of a basic variable, an auxiliary variable, a glued variable, a mapped variable, an integrated variable.

117. (New) The system of Claim 111, wherein the type is one of a basic variable, an auxiliary variable, a glued variable, a mapped variable, an integrated variable.